REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	RELEASED ON ECN #E1553	09/08/03	MA

1. **Specification subject to change without notice.**
2. **All dimensions and specifications apply to standard modules. This information may vary for modules with optional features.**
3. **All dimensions are in millimeters.**
4. **Precautions:These precautions apply equally to modules from all makers, not just Densitron. Violation of these guidelines may void the warranty and can cause problems ranging from erratic operation to catastrophic display failure.**

Handling precautions:
♦ This device is susceptible to Electro-Static Discharge (ESD) damage. Observe Anti-Static precautions.

Power supply precautions:
♦ Identify and, at all times, observe absolute maximum ratings for both logic and LC drivers. Note that there is some variance between models.
♦ Prevent the application of reverse polarity to V_{DD} and V_{SS}, however briefly.
♦ Use a clean power source free from transients. Power up conditions are occasionally "jolting" and may exceed the maximum ratings of the module.
♦ The +5V power of the module should also supply the power to all devices which may access the display. Don't allow the data bus to be driven when the logic supply to the module is turned off.
♦ DO NOT install a capacitor between the V_O (contrast) pin and ground. V_{DD} must, at all times, exceed the V_O voltage level. The capacitor combines with the contrast potentiometer to form an R-C network which "holds-up" V_O, at power-down, possibly damaging the module.

Operating precautions:
♦ DO NOT plug or unplug the module when the system is powered up.
♦ Minimize the cable length between the module and host MPU. (Recommended max. length 30 cm).
♦ For models with EL backlights, do not disable the backlight by interrupting the HV line. Unloaded inverters produce voltage extremes which may arc within a cable or at the display.
♦ Operate the module within the limits of the modules temperature specifications.

Mechanical / Environmental precautions:
♦ Improper soldering is the major cause of module difficulty. Use of flux cleaner is not recommended as they may seep under the elastomeric connection and cause display failure. Densitron recommends the use of Kester "245" no-clean solder.
♦ Mount the module so that it is free from torque and mechanical stress.
♦ Surface of LCD panel should not be touched or scratched. The display front surface is an easily scratched, plastic polarizer. Avoid contact and clean only when necessary with soft, absorbent cotton dampened with petroleum benzene.
♦ ALWAYS employ anti-static procedure while handling the module.
♦ Prevent moisture build-up upon the module and observe the environmental constraints for storage temperature and humidity.
♦ DO NOT store in direct sunlight.
♦ If leakage of the liquid crystal material should occur, avoid contact with this material, particularly ingestion. If the body or clothing becomes contaminated by the liquid crystal material, wash thoroughly with water and soap.

Notes: (unless otherwise specified)

Unless otherwise specified: Dimensions are mm Tolerances are: X = ± 3 .X = ± 0.5 .XX = ± 0.05 Cage Code #OWS52	APPROVALS	DATE	DENSITRON TECHNOLOGIES PLC	
	DRAWN			
	CHECKED		TITLE LCD MODULE COB 2 LINE X 20 CHARACTERS	
	ISSUED		DWG. NO. LC4305	SHEET 1 OF 8

1.0 DESCRIPTION

Dot matrix display module consisting of a Liquid Crystal Display, CMOS driver and controller LSI, printed circuit board and metal support frame and array type Light Emitting Diode (LED) backlight.

Available LC fluids types are: STN (supertwisted nematic), STN-H (extended temperature range STN).

2.0 MECHANICAL CHARACTERISTICS

Item	Specifications	Unit
Package Dimensions	180.0 (W) x 40.0 (H) x 16.7 max.(D)	mm
Display format	2 line x20 characters	-
Character font format	5 (W) x 7 (H) with attached cursor	dots
Driving method	1/16	duty
Dot size	1.12 (W) x 1.12 (H)	mm
Dot pitch	1.22 (W) x 1.22 (H)	mm
Character Size	6.0 (W) x 9.66 (H)	mm
Active display area	142.8 (W) x 20.64 (H)	mm
Viewing area	149.0 (W) x 23.0 (H)	mm
Weight		g

Notes: W-Width;H-Height;D-Depth.

3.0 ABSOLUTE MAXIMUM RATINGS

$V_{SS}=0V$; $T_a=25°C$

Item	Symbol	STN		STN-H		Unit
		Min.	Max.	Min.	Max.	
Logic supply voltage	V_{DD}-V_{SS}	0	7	0	7	V
LC driver supply voltage	V_{DD}-V_O	0	6	0	10	V
Operating temperature	T_{OP}	0	+50	-20	+70 (Note 3)	°C
Storage temperature (Note 1)	T_{ST}	-20	+70	-30	+80	
Humidity: Operating (@40°C)	-	-	85%	-	85%	RH (Note 2)
Non-operating (@40°C)	-	-	95%	-	95%	RH (Note 2)

Notes: 1: Tested to 100 hrs.
2: Refers to non-condensing conditions.
3. With backlight off.

4.0 ELECTRICAL CHARACTERISTICS

$V_{DD}=5\pm0.25V$; $T_a=25°C$

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input "High" voltage	V_{IH}	-	2.2	-	V_{DD}	V
Input "Low" voltage	V_{IL}	-	-	-	0.6	V
Output "High" voltage	V_{OH}	$I_{OH}=0.205mA$	2.4	-	-	V
Output "Low" voltage	V_{OL}	$I_{OL}=1.2mA$	-	-	0.4	V
Power supply current	I_{DD}	$V_{DD}=5.0V$	-	2.5	-	mA

5.0   RECOMMENDED LC DRIVE VOLTAGE (V_{DD}-V_O)

VDD=5.0±0.25V

Temperature	STN	STN-H
Ta= -20°C	-	7.9
Ta= 0°C	4.9	7.5
Ta= 25°C	4.5	7.2
Ta= 50°C	4.2	6.8
Ta=70°C	-	6.4

6.0   BACKLIGHT SPECIFICATIONS:

Ta=20°C,60%RH,Darkroom.

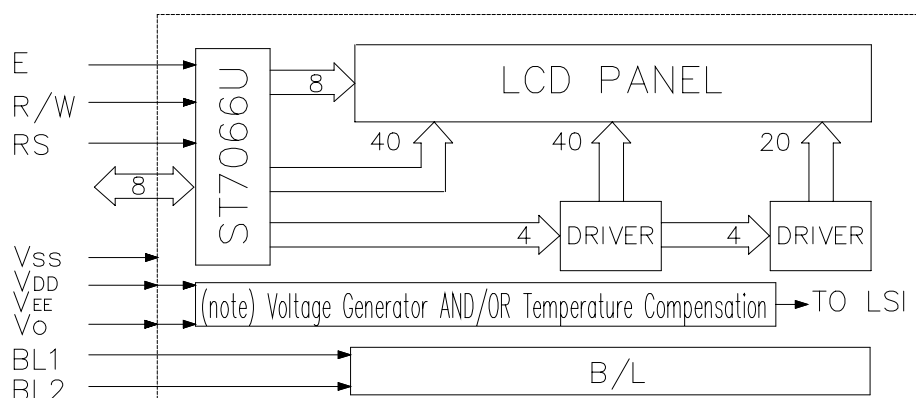| Item	Symbol	Typ.	Max.	Unit
LED lamp input voltage	V_{LED+}	5	6	VDC
LED lamp input current	I_{LED}	560	620	mA
Build-in current limiting resistor	R1	-	-	Ohms, W
External current limiting resistor (recommended)	R2	1.5 Ohms, 2W	-	Ohms, W
Number of nodes	N	56	-	-

N = 56 , I = 10 mA
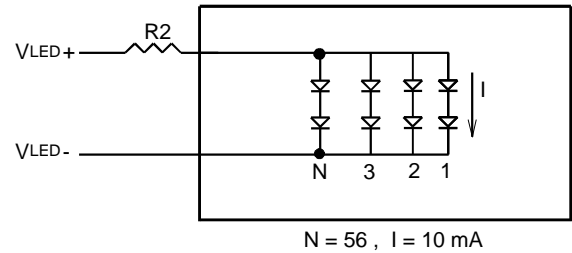
7.0   POWER SUPPLY
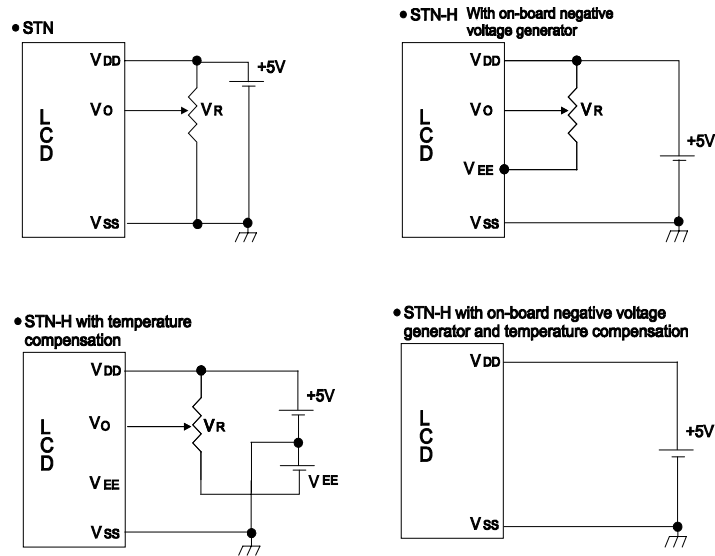
8.0 INTERFACE DESCRIPTION

Pin No.	Symbol	I/O	Function
1	V_{SS}	-	Ground (0V), LED-
2	V_{DD}	-	Logic Supply Voltage
3	V_O	-	LC Drive voltage for contrast adjustment
4	RS	I	Register Select 0: Instruction Register 1: Data Register
5	R/W	I	Read / Write 0: Data Write (Module←MPU) 1: Data Read (Module→MPU)
6	E	I	Enable Signal Active High (H→L)
7	DB0	I/O	Bi-directional data bus line 0
8	DB1	I/O	Bi-directional data bus line 1
9	DB2	I/O	Bi-directional data bus line 2
10	DB3	I/O	Bi-directional data bus line 3
11	DB4	I/O	Bi-directional data bus line 4
12	DB5	I/O	Bi-directional data bus line 5
13	DB6	I/O	Bi-directional data bus line 6
14	DB7	I/O	Bi-directional data bus line 7
15	N/C (V_{EE})	-(O)	No connection (Negative voltage output for models with on-board negative voltage generator)
16	V_{LED}+	-	Supply voltage for backlight (+5V)
BL1	V_{LED}+	-	Supply voltage for backlight (+5V)
BL2	V_{LED}-	-	Supply voltage for backlight (Ground)

9.0 BLOCK DIAGRAM:

10.0 TIMING CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Enable cycle time	T_{cycE}	1.0	-	-	nS
Enable pulse width	PW_{EH}	450	-	-	nS
Enable rise / fall time	t_{Er}/t_{Ef}	-	-	20	nS
Address set-up time	t_{AS}	140	-	-	nS
Address hold time	t_{AH}	10	-	-	nS
Data delay time	t_{DDR}	-	-	320	nS
Data hold time (Write)	t_{DHW}	10	-	-	nS
Data hold time (Read)	t_{DHR}	20	-	-	nS
Data set-up time	t_{DSW}	195	-	-	nS

WRITE OPERATION
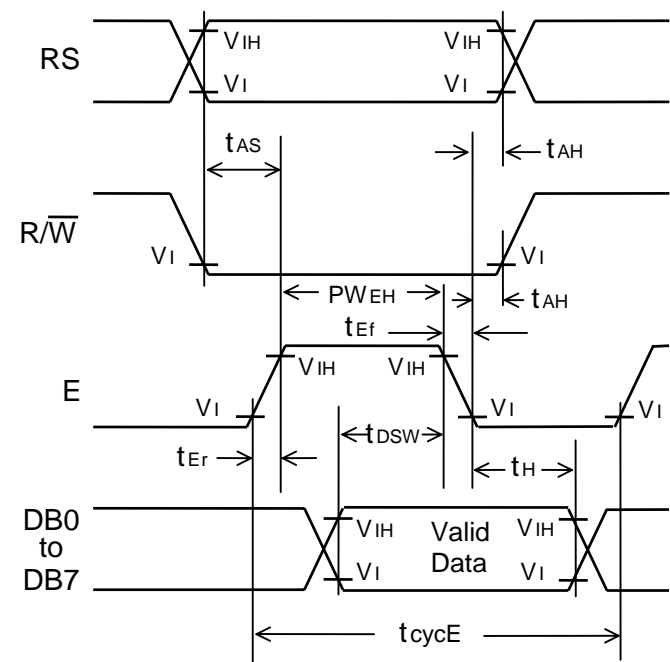
READ OPERATION
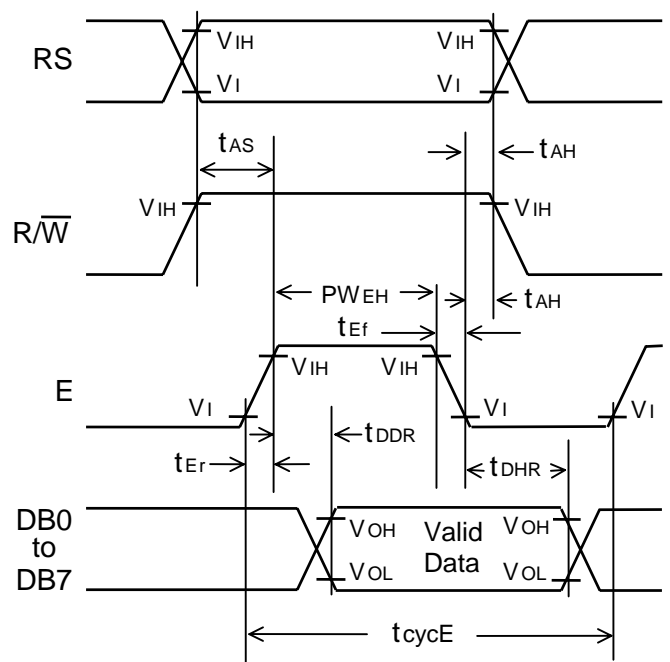
11.0 DD RAM ADDRESS vs. DISPLAY POSITION

Character	1	2	3	4	5	6	7	8	9	10	11	---	18	19	20
Line 1	00	01	02	03	04	05	06	07	08	09	0A	---	11	12	13
Line 2	40	41	42	43	44	45	46	47	48	49	4A	---	51	52	53

12.0 OPTICAL CHARACTERISTICS

Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Contrast ratio STN		K	$\varnothing=20°\ \theta=0°$	4	-	-	-
Contrast ratio STN-H		K	$\varnothing=20°\ \theta=0°$	5	-	-	-
Viewing angle	STN	$\varnothing2-\varnothing1$	$\theta=0°\ K\geq1.4$	40	-	-	Deg.
		θ	$\varnothing=20°\ K=1.4$	±30	-	-	Deg.
Viewing angle	STN-H	$\varnothing2-\varnothing1$	$\theta=0°\ K\geq1.4$	40	-	-	Deg.
		θ	$\varnothing=20°\ K=1.4$	±40	-	-	Deg.
Response time	Rise	t_r	$\varnothing=20°\ \theta=0°$	-	150	250	mS
	Fall	t_f	$\varnothing=20°\ \theta=0°$	-	150	250	mS

DEFINITION OF CONTRAST
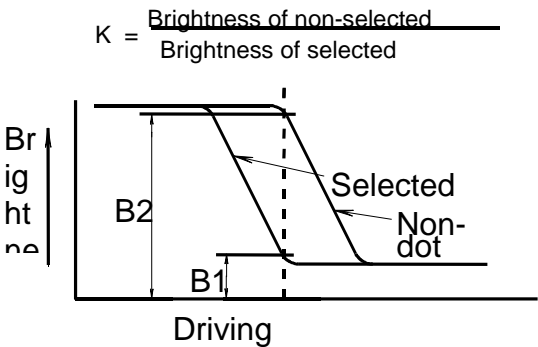
$$K = \frac{\text{Brightness of non-selected}}{\text{Brightness of selected}}$$

Brightness

B2

B1

Selected

Non-dot

Driving

CONTRAST VERSUS

Contras

STN, STN-H: $\varnothing1 < 0°$

1.4

$\varnothing1$ $\varnothing2$

Viewing

DEFINITION OF θ

$\varnothing2$
$\varnothing1$

Y

X   X'

θ

Y'

DEFINITION OF OPTICAL

Non-selected   Selected   Non-selected

Brightne

10% 0%   90%   10%

t_r t_f

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13.0 MODULE DIMENSIONS

40.0±0.5
37.0±0.3
32.0±0.2
2.5±0.3
4.0±0.2
4.5±0.3
23.0 ±0.3
8.38±0.2
2.54X7 =17.78

4.0±0.2
5.9±0.3
12.4±0.3

180.0±0.5
172.0±0.2
162.0±0.3
149.0±0.3
142.8

16
5
2
1

16-Ø1.0 HOLE

4-Ø3.5 HOLE

14.54
1.765
0.06

6.0
1.152
1.2
0.06

2.5
5.08
BL2
17.46
BL1
2-Ø1.0 Hole

1.6±0.2
max. 5.0
max 11.7
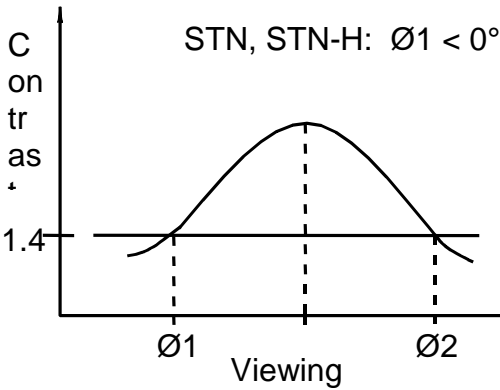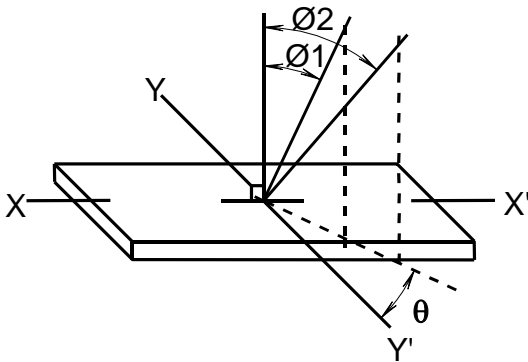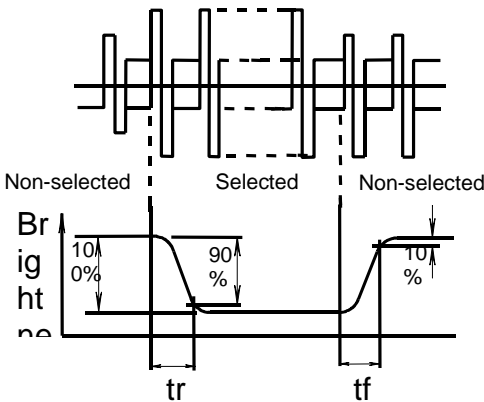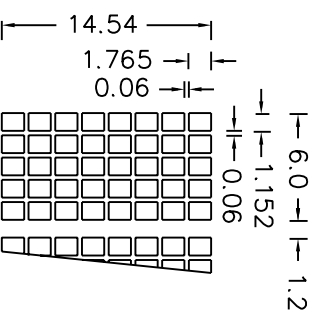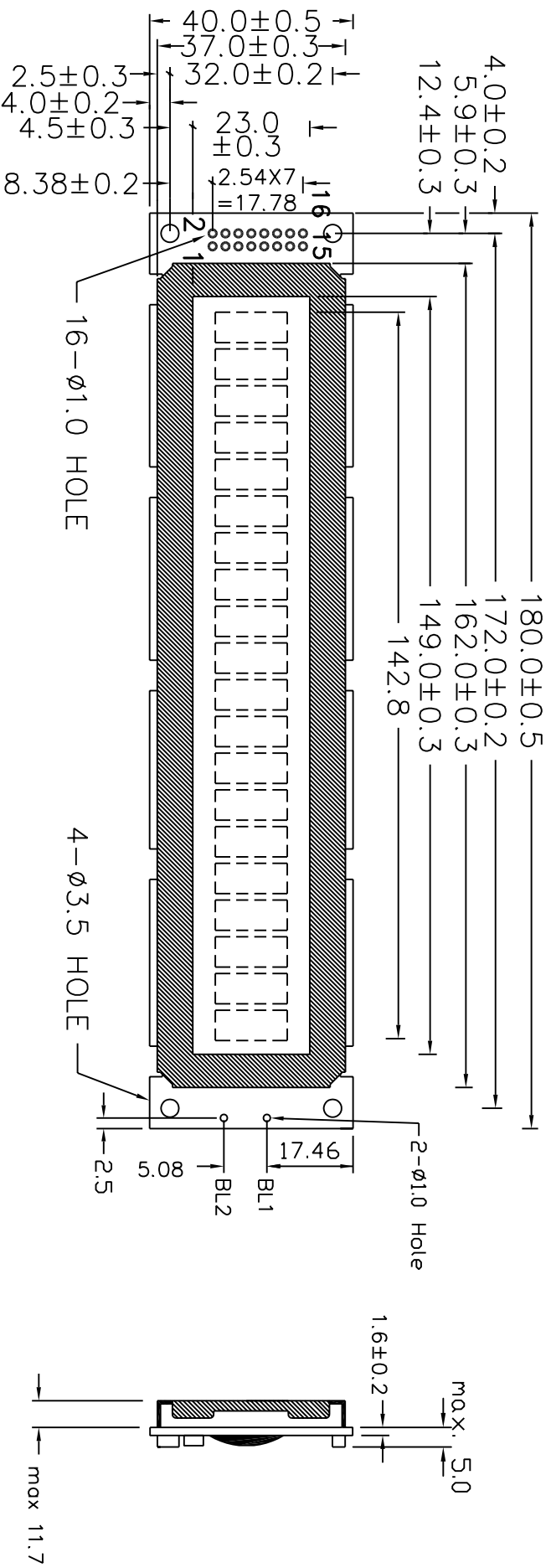
14.0 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

LC4305①②2C20③④⑤

① **Polarizer Type**

B = Transflective: light background with LED backlight
E = Transmissive: dark background with LED backlight
F = Transmissive: light background with LED backlight

② **Backlight Color**

G = Yellow-green (standard)
R = Red

③ **Fluid Type and Power Supply**

S = STN with +5VDC operation
H = STN-H with ±5VDC operation
W = STN-H fluid with +5VDC operation (on-board negative voltage generation)

④ **Fluid Type Viewing Direction**

N = STN, STN-H
C = STN, STN-H with on-board temperature compensation circuitry

⑤ **Background Color for STN Temperature Range**

B = Blue background
G = Gray background
Y = Yellow background

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